What is claimed is:

1. A method for repairing a defect in a photolithographic mask for semiconductor patterning, the photolithographic mask having a first layer with a first light transmittance and a second layer having a second light transmittance differing from the first, the second layer being removable in at least one pre-selected region to form a pattern, the second layer, when intact, causing a phase shift in light waves that pass through it relative to light passing through the first layer alone, and, when absent in a region not a subset of the pattern, constituting the defect, the method comprising the steps of:

identifying the location of the defect; and

introducing a pre-selected phase change at substantially the defect location.

2. The method according to claim 1, wherein the step of introducing a pre-selected phase change comprises modifying the thickness of the first layer at substantially the defect location to a pre-selected dimension.

3. The method according to claim 2, wherein the step of modifying the thickness of the first layer at substantially the defect location to a known dimension comprises causing a reduction in thickness to the pre-selected dimension.

4. The method according to claim 2, wherein the step of modifying the thickness of the first layer at substantially the defect location to a known dimension comprises causing an increase in thickness to the pre-selected dimension by applying material of known transmittivity.

5. The method according to claim 4, wherein the applied material of known transmittivity comprises more than one layer, each being of a material having known transmittvity.

6. The method according to claim 1, comprising the further step, prior to modifying the thickness of the first layer, of removing a portion of the second layer adjacent the defect to create a repair zone.

7. The method according to claim 3, wherein the removal of the portion of the second layer adjacent the defect to create the repair zone comprises removing a portion of the second layer having regular geometry.

8. The method according to claim 7, wherein the regular geometry comprises at least one rectangle.

9. The method according to claim 7, wherein the regular geometry comprises at least one curvlinearly shaped portion.

10. The method according to claim 6, comprising the further step of depositing at substantially the repair zone a material having a pre-selected transmittance.

11. The method according to claim 6, comprising the further step of depositing at substantially the repair zone a material having a pre-selected index of refraction.

12. The method according to claim 6, comprising the further step of depositing at substantially the repair zone a material having a pre-selected transmittance and a pre-selected index of refraction.

13. The method according to claim 12, wherein the reduction in thickness of the first layer at substantially the defect location comprises a lacuna in the first layer and the

material deposited at the repair zone fills the lacuna and the repair zone to a depth having an average value substantially equal to a pre-selected value.

14. The method according to claim 12, wherein the pre-selected value of the average depth of the material deposited at the repair zone is computed as a function of at least one physical characteristic of the deposited material.

15. The method according to claim 13, wherein the pre-selected value of the average depth of the material deposited at the repair zone is computed as a function of at least one physical characteristic of the material of the first layer.

16. The method according to claim 13, wherein the pre-selected value of the average depth of the material to be deposited at the repair zone is computed as a function of at least one physical characteristic of the material to be deposited and an at least one physical characteristic of the material of the first layer.

17. The method according to claim 13, wherein the transmittance and index of refraction of the deposited material and the depth of the lacuna are selected to so that light of a known intensity and phase passing through the repair zone following deposition of the material will have a pre-selected intensity, and a pre-selected phase angle relative to a reference phase angle, upon emerging from the photolithographic mask.

18. The method according to claim 13, wherein the pre-selected phase of the light emerging from the photolithographic mask is at a phase angle of substantially 180 degrees relative to the light incident on the photolithographic mask.

19. A photomask for use in the fabrication of integrated circuits comprising:

a first layer;

a second layer having a primary and substantially constant thickness and a region of altered thickness, the altered thickness causing a pre-selected phase shift in light passing through it relative to the phase of light incident upon the region of altered thickness.

20. The photomask according to claim 19, wherein the region of altered thickness of the second layer comprises a region of reduced thickness.

21. The photomask according to claim 20, wherein the reduction in thickness comprises a reduction having a pre-selected magnitude.

22. The photomask according to claim 20, wherein the magnitude of the reduction in thickness is selected to shift the phase of light waves passing through the area of reduced thickness to a pre-selected degree relative to light waves incident upon the area.

23. The photomask according to claim 20, wherein the first layer comprises a material that has been removed at a location substantially overlapping the region of reduced thickness of the second layer.

24. The photomask according to claim 21, further comprising a repair material at the location in the first layer from which material has been removed.

25. The photomask according to claim 21, wherein the repair material has a transmittance falling in a pre-selected range.

26. The photomask according to claim 25, wherein the patch material has an index of refraction falling into a pre-selected range.

27. The photomask according to claim 26, wherein the magnitude of the reduction in thickness of the first layer is selected at least in part on the basis of a physical characteristic of the repair material.

28. The photomask according to claim 27, wherein the physical characteristics of the patch material forming a basis for the selection of the magnitude of the reduction in thickness of the first layer comprises an index of refraction of the material.

29. A method for repairing a clear defect in a photomask having a first substantially transmitting layer and a second layer having lower transmittance than the first layer, the clear defect having a known location, the method comprising the step of introducing a phase error due to the first layer substantially at the location of the defect.

30. The method according to claim 29, wherein the step of introducing the phase error comprises modifying the thickness of the first layer in substantially the location of the defect.

31. The method according to claim 30, further comprising the step of depositing a repair material, having a pre-selected transmittance, at substantially the location of the defect.

32. A method for patterning a wafer for use in a semiconductor circuit, the method comprising the steps of:

providing a photolithographic mask for producing a pattern on the wafer;

identifying a defect in the photolithographic mask and the location of the defect on the mask;

introducing a pre-selected phase change at substantially the location of the defect;

repairing the defect; and

transmitting light through the photolithographic mask to the wafer to pattern the wafer.

33. The method according to claim 32, wherein the step of introducing a pre-selected phase change comprises the step of identifying the pre-selected phase change as a function of a material to be applied to repair the defect.

34. The method according to claim 32, wherein the photolithographic mask comprises a first layer having a first light-transmitting characteristic and a second layer applied to the first and having a second light-transmitting characteristic, the step of introducing a pre-selected phase change comprising the step of identifying the pre-selected phase change as a function of at least one of the first and second light transmitting characteristics.

35. The method according to claim 32, wherein the first light transmitting layer comprises a substantially transparent substrate layer.

36. The method according to claim 35, wherein the second light transmitting layer comprises an attenuator layer having substantially lower light transmittivity than the substrate layer.

37. The method according to claim 35, wherein the step of introducing a pre-selected phase change comprises modifying the thickness of the substrate layer.

38. The method according to claim 36, wherein the step of introducing a pre-selected phase change comprises modifying the thickness of the substrate layer.

39. The method according to claim 38, wherein the modification of the thickness of the substrate layer comprises a reduction in thickness of the substrate layer.

40. The method according to claim 39, wherein the degree of the reduction in thickness of the substrate layer is pre-selected as a function of at least one of the first and second light transmission characteristics and a light transmission characteristic of the repair material.

41. The method according to claim 40, wherein the function of at least one of the first and second light transmission characteristics comprises a function of both the first and second light transmission characteristics and also of the light transmission characteristic of the repair material.

42. The method according to claim 32, further comprising the step, prior to the step of introducing a pre-selected phase change, of preparing a repair zone substantially at the location of the defect.

43. The method according to claim 42, wherein the repair zone is of a regular geometric shape.

44. The method according to claim 42, wherein the repair zone is of a minimizal size still capable of circumscribing the defect.

45. The method according to claim 37, wherein the step of repairing the defect comprises depositing repair material to the substrate at the point of modified thickness and to the repair zone.

46. The method according to claim 45, wherein the deposited material has a thickness, in a dimension perpendicular to the plane of the photolithographic mask, selected to produce a pre-selected phase change of light passing through the repair location, the phase change due to both to the repair material of that thickness and to the substrate of modified thickness.

47. The method according to claim 46, wherein the substrate and attenuator layers, at sites having no defect, together produce a given phase change and the value of the pre-selected phase change of the light passing through the repair location is chosen to be substantially equal to the phase change due to the substrate and the attenuator layers at sites having no defect.

48. A semiconductor wafer comprising a surface patterned using a photomask, the photomask having a defect repaired by introducing a pre-selected phase change at substantially the location of the defect, the wafer surface pattern comprising a feature formed at least in part by light passing through the repaired defect.